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Awareness, attitude, and practice of Pediatricians in relation to *Helicobacter pylori infection*, diagnosis, and management in Rwanda.

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ABSTRACT

Background

Helicobacter pylori infection (HPI) is a global public health problem, believed to cause more than 300,000 deaths each year. This study explores pediatricians' awareness, attitudes, and practice regarding diagnosing and managing HPI in Rwanda.

METHODOLOGY

This descriptive cross-sectional study was conducted from May to June 2022 in Rwanda. Among eighty registered pediatricians, 66 were recruited based on a simple random sampling approach. A self-administered questionnaire was distributed by the lead researcher. Data were analyzed using SPSS software and a p-value of ≤ 0.05 was considered significant.

RESULTS

Among sixty-six recruited participants, more than half (57.6%) initiate testing from 5-12 years of child's age, 86.4% treated the infection after investigation and the most requested investigations were: stool antigen (90.6%), serology test (46.9%), and endoscopic exam (31.3%). Participants from public institutions were more likely to utilize stool antigen (90.0% vs 50.0%, OR:1.800, p=0.006) and less likely to utilize serology tests (40.0% vs 83.3%, OR:0.480, p=0.041). Participants with the rank of consultant or beyond were more adherent to a 14-day antibiotic regimen than junior consultants (55.0% vs 26.9%, OR:1.624, p=0.025.

CONCLUSIONS

Rwandan pediatricians are aware of the current evidence on *H. pylori* and are willing to utilize evidence-based guidelines. The results express a need to institutionalize the existing evidence on HPI among the pediatric population and a need to promote continuous medical education for capacity building of the pediatricians. Where possible, hospitals should create and sustain the inter-facility agreement to utilize the existing minimum capacity, to serve the maximum number of patients, as stated by Sustainable Development Goal 17.

Keywords: Helicobacter pylori; pediatricians; Management; Rwanda.

INTRODUCTION

Helicobacter pylori infection (HPI) is a global public health problem, believed to cause more than 300,000 deaths each year [1-3] and it is classed as a "class I carcinogen" by the World Health Organization (WHO) [4,5].

The prevalence of HPI varies from 20% to 90%, with disproportionately higher prevalence in low and middle-income countries (LMIC) relative to high-income countries (HIC) [6,7].

Regardless, the key factors that were reported to increase the risk for HPI in both HIC and LMIC were often correlated with the socioeconomic status of the households, overcrowding in housing, the number of people in the family, and older siblings [8,9].

In Rwanda, it is found in 80% of adult patients aged between 15 to 92 years with gastritis at CHUK from 2016 to 2018 [10]. Two approved methods for diagnosing HPI are usually categorized on whether they are non-invasive, minimally invasive, or invasive methods with upper gastro-intestinal endoscopy with sample for biopsy [11,12]. The course of management of HPI takes 14 days using the combination of proton pump inhibitor plus amoxicillin and clarithromycin or an imidazole or bismuth salts, amoxicillin, and imidazole or sequential therapy was recommended as the first-line regimen for *H. pylori* eradication [13].

The existing guidelines and recommendations have reflected on specific situations based on the prevalence burden of the infection in LMIC, the limited resources at health facilities, and the residence in the pharmacological therapy [14,15].

There is a paucity of treatment guidelines among the pediatric and adolescent population in LMIC, yet, these guidelines are needed by healthcare professionals to ensure the provision of quality care based on correct diagnosis-based management among children with HPI [12].

Given this paucity of guidelines based on community-specific data, there is a need for healthcare professionals to utilize the already developed guidelines by recognized professional organizations and adapt them to the context of their communities.

No data exists in Rwanda regarding the awareness, attitude, and practice of Rwandan pediatricians on the management of HPI which leaves a gap to be filled by research. This study aimed to explore pediatricians' awareness, attitudes, and practice on diagnosing and managing HPI in Rwanda and to document the disparities in practice based on the pediatricians' workplace and experience.

Study design

This was a descriptive, cross-sectional study conducted from May to June 2022.

Study site

The study was conducted in pediatric departments of both private and public health facilities in Rwanda with pediatricians. We contacted licensed pediatricians from their workplaces in private and public health facilities.

Study population

Participants were licensed pediatricians working in public or private facilities in Rwanda

Inclusion criteria

We included pediatricians who were willing to participate in the study.

Exclusion criteria

Participants who are part of the research team, directly involved in the study, and whose health condition would not allow participation in conscious responses were excluded.

Sampling Procedure

A simple random sampling technique was used to retrieve contacts of 66 pediatricians from the Rwanda Pediatrics Association registry. The selected pediatricians were then contacted via email and contact phone for an appointment to receive an explanation about the study.

Data Collection Methodology

Data were collected by the lead researcher using a self-administered questionnaire. For better utilization of time and resources, each participant was given options to participate by filling out a printed questionnaire or by filling out the online version of the same questionnaire. A questionnaire (both digital and printed) was then distributed according to the participant's choice.

The survey asked questions about the respondents' personal demographic information, the criteria used to test for HPI, the use, and selection of diagnostic tests, the criteria used to treat HPI, the choice of the treatment regimen, the respondents' awareness of prescription rates, and the sources of information they were familiar with regarding HPI. Due to the lack of an *H .pylori* KAP evaluation tool, especially for high-risk populations, a tool was made using the world health organization for creating a KAP survey [16].

Data analysis

Once a database had been created in Microsoft Excel® using the obtained data, it was then imported to IBM SPSS version 25 for analysis. The chi-square test was used to analyze the association between outcomes and predictors/risk variables. Categorical data were displayed using frequencies and percentages in tables and charts, while continuous data were summarized by means and median values based on their distribution. With a p-value of 0.05 or below, relationships were considered statistically significant. We looked at pediatricians' general replies as well as the subgroups by demographic traits.

We created a dichotomous variable for several Likert scale survey items by merging categories as agree (for agree and strongly agree) and disagree (for disagree and strongly disagree).

Ethical considerations

The study protocol was reviewed and approved by the University of Rwanda Institutional Review Board (IRB) (No 350/ CMHS IRB / 2022).

Funding and sponsors

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Potential conflict of interest

The author declares no competing interest in this study.

RESULTS

During this study, a total of sixty-six pediatricians were recruited and responded to the research questions.

Most participants, 38 (57.6%), reported that they initiate HPI testing among children aged five to twelve years of age, 36.4% reported from one to five years, 3.0% reported infancy period below one year of age, and 3.0% reported above twelve years as the earliest age they start testing and treating HPI in children.

Across all the groups, the age category of five to twelve years was consistently reported as the most common child period where pediatricians initiate testing and treating HPI. The participants in this study had had different experiences with HPI in children and the available modalities to diagnose HPI. The largest proportion (86.4%) of participants reported that they treat HPI after ordering investigations for the infection while 13.6% reported it as not their practice. Regarding the diagnostic tests used, 58 (90.6%) and 30 (46.9%) reported that they order stool and serology antigen tests respectively even though these tests were available at the workplace among only 47 (71.2%) and 5 (7.6%) respectively.

Furthermore, 20 (31.3%) requests for the endoscopic exam even though it was reported as available at the workplace among only 10 (15.2%).

The biggest proportion (93.8%) of respondents supported that guideline-informed management would minimize diagnostic errors and promote the appropriate treatment for HPI while the remainder disagreed or strongly disagreed with the statement. All participants (100%) and 93.1% respectively from private and public health facilities were in positive agreement with the role of guideline-informed management in reducing diagnostic errors and promoting appropriate care.

Table 1: Participants' attitude on guideline-informed management to minimize diagnostic error and promote appropriate treatment.

		GIM would minimize diagnostic error and promote appropriate treatment for HPI, N (%)	
		Agree	Disagree
Working Place	Public	54 (93.1)	4 (6.9)
	Private	6 (100)	0 (0)
Additional training	Yes	6 (85.7)	1 (14.3)
	No	54 (94.7)	3 (5.3)
Title	Junior consultant	24 (92.3)	2 (7.7)
	Consultant and beyond	36 (94.7)	2 (5.3)
Experience	0-5 years	42 (93.3)	3 (6.7)
	> 5 years	18 (94.7)	1 (5.3)
Reads journals	Yes	49 (94.2)	3 (5.8)
	No	11 (91.7)	1 (8.3)
Total		60 (93.8)	4 (6.3)

GIM: Guideline-informed management

By the time of our data collection, 51 (78.5%) agreed or strongly agreed that quality guidelines were sufficiently available for the management of HPI.

However, only 14 (25%) agreed or strongly agreed that the quality guidelines and resources such as testing kits, and standard operating procedures were sufficiently available at their workplace. Furthermore, 61 (92.4%) agreed or strongly agreed that HPI is significantly associated with different GIT disorders. All the respondents expressed their determination to implement evidence-based guidelines when available.

The participants in this study revealed their awareness regarding HPI, their eagerness to seek clinical guidelines, and how they use the clinical guidelines to manage HPI among children in Rwanda. In a pick-all that applies question (allowing to choose more than one option) on the pediatrician's source of medical information, more than two-thirds (78.8%) highlighted medical journals, 56.1% mentioned internet sources, while 19.7%

highlighted the NASPGHAN. Other sources of information were conferences (9.1%), newsletters (4.5%), and symposia sponsored or organized by pharmaceutical companies (3.0).

Regarding respondents' awareness of existing journals, 80.3% responded that they were aware of the journals and read them often, 15.2% responded that, though they were aware of the journals, they never read them and 4.5% revealed they were not aware of the HPI journals at all. The most frequently visited journal by the respondents in this study for HPI guidelines updates was the American College of Gastroenterology's Practice Guidelines on HPI 43.9%, followed by ESPGHAN HPI guidelines (22.7%) and NASPGHAN GERD guidelines (21.2%). The least visited journal was the Digestive Health Foundation's HPI Information Hotline representing 9.1% of all participants in this study. Only two-thirds (65.2%) of the participants revealed that they always rely on published guidelines to manage HPI while the remaining reported that they less often rely on published guidelines.

Moreover, all participants highlighted treating the HPI with a combination of oral antibiotics and a proton pump inhibitor (PPI). Even though the choice of antibiotics was different among the participants, the use of amoxicillin remained constant across all responses, and it is combined with either clarithromycin (59.1%) or another antibiotic (40.9%).

Furthermore, most participants (56.1%) mentioned prescribing antibiotics for fourteen days while the remaining prescribe the antibiotics either for less than 14 days (minimum reported: 7 days) or more than 14 days (maximum reported: 3 months). Regarding the use of PPI, the participants reported prescribing either omeprazole (30.3%) or esomeprazole (69.7%). The participants shared their current practice on how they confirm HPI eradication among affected children and 12.1% reported confirming by using a combination of control tests in addition to a clinical evaluation, while 87.9% reported using only clinical evaluation (6.1%) or control test (81.8%) alone.

The pediatricians with no additional training beyond the Master of Medicine degree were significantly more likely to practice the request of diagnostic tests relative to other pediatricians with additional training such as Ph.D. or subspecialty training (89.7% vs 62.5%, p=0.036, OR:1.434, 95%CI: 0.833-2.471). Pediatricians with a professional experience of 0 to 5 years were more likely to utilize the investigation tests as compared to others with a more advanced professional experience even though the difference was not statistically significant (91.1% vs 76.2%, p=0.100, OR:0.926-1.545). Similarly, junior consultants did not significantly differ from professionals ranked as consultants or beyond (84.6% vs 87.5%, p=0.739, OR:0.967, 95%CI: 0.791-1.183).

There are disparities in using different diagnostic tests among our study participants. The pediatricians in public health institutions were significantly more likely to use stool antigen as the diagnostic test than their private institution's counterparts (90.0% vs 50.0%, p=0.006, OR:1.800, 95%CI: 0.805-4.024). On the other hand, the pediatricians from private health institutions were significantly more likely to use serology tests to diagnose HPI relative to pediatricians in public institutions (83.3%, vs 40.0%, p=0.041, 95%CI:0.299-0.771).

However, there was no significant difference in the utilization of endoscopy to diagnose HPI in public institutions and private institutions even though the former had higher odds (31.7% vs 16.75, p=0.446, OR:1.900, 95%CI: 0.306-11.814).

Moreover, participants with more than 5 years of professional experience as pediatricians expressed a non-significant higher likelihood of using endoscopy (33.3% vs 28.9%, p=0.714, OR: 1.231, 95%CI: 0.404-3.746) and serology antigen (52.4% vs 40%, p=0.345, OR:0.764, 95%CI: 0.444-1.314) than the less experienced participants. Similarly, participants who were ranked as consultants or beyond did not significantly differ from their counterparts in the use of endoscopy (32.5% vs 26.9%, p=0.630, OR:1.307, 95%CI: 0.439-3.888), stool antigen (90.0% vs 80.8%, p=0.286, OR:2.143, 95%CI: 0.518-8.871), and serology antigen test (47.5% vs 38.5%, p=0.470, OR:1.448, 95%CI: 0.530-3.953) to diagnose HPI.

The combination of amoxicillin and clarithromycin remained the most preferred antibiotic therapy both in public (58.3%) and private (66.7%) health institutions (p=0.692, OR:0.700, 95% CI:0.119-4.123).

In addition, only half of the participants from the private institution (50.0%) were prescribed antibiotics for 14 days with no significant difference from public practitioners (56.7%, p=0.754, OR:1.133, 95%CI: 0.494-2.600) and the remaining were either using fewer days or more extended duration of pharmacological therapy.

The junior consultants had a slightly non-significant higher likelihood of preferring clarithromycin as the best choice to combine with amoxicillin relative to consultants and beyond (61.5% vs 57.5%, p=0.744, OR: 0.905, 95%CI: 0.494-1.658), but the latter were significantly more likely to prescribe the antibiotics for 14 days (73.1% vs 45.0%, p=0.025, OR:1.624, 95%CI: 1.073-2.458). One-third (33.3%) of the participants with a professional

experience of more than 5 years preferred an antibiotic other than clarithromycin to combine with amoxicillin as it was found in 44.4% of the participants with an experience of 0 to 5 years (p=0.392, OR:1.333, 95CI: 0.67-2.651). Also, only less than two-thirds (62.2%) of participants with 0 to 5 years of experience were prescribing antibiotics for 14 days which was statistically comparable to only 42.9% of the participants with more than 5 years of professional experience (p=0.140, OR:0.455, 95CI: 0.159-1.306).

Regarding the participants' practice on confirmation of eradication, 23.8% of the participants with more than 5 years of experience were significantly more likely to use both a clinical evaluation and a control test compared to only 6.7% of their counterparts with less experience (p=0.047, OR:1.225, 95%CI: 0.953-1.575). While 33.3% of participants from private health institutions confirm the eradication based on both clinical progress and control test, 90.0% of participants from public institutions use the clinical evaluation alone or a control test alone (p=0.095, OR:1.350, 95%CI: 0.762-2.392).

DISCUSSIONS

This study aimed at exploring the awareness of Rwandan pediatricians regarding HPI management evidence, their attitudes, and their practice on the management of HPI among the pediatric population.

The Rwandan pediatricians in this study have demonstrated the main source of information such as medical journals (78.8%) as the pediatricians in the United States of America (USA), among whom, 81% mentioned the medical journals during an internet-based survey among NASPAGHAN members [17].

However, the study in the USA showed higher rates of pediatricians getting information from conferences (17%) relative to the results from our study (9.1%).

Furthermore, nearly two-thirds of the participants in this study reported relying their practice on published guidelines and this is higher than the results from Israeli where only 50% of primary care pediatricians reported using professional guidelines in the management of HPI [18].

The results from this study highlight that only 39% of Rwanda pediatricians explore the testing for HPI for children before attaining the fifth birthday, including only 3% who test for the infection among children in their first year of life. Even though HPI has been long believed to start manifestations during early adulthood or even later in adulthood, more recent studies have demonstrated the infection to be prevalent among children from as early as 4 months (43% of children) in Iran, with a cumulative increase in prevalence as the children age [19], and case reports of rare presentation among newborns [20].

Additionally, prior studies in Uganda, a neighboring country of Rwanda, have found a prevalence of 33.3% of HPI among children aged less than 6 months [21]. This indicates a missed opportunity to timely diagnose HPI among under-five children, which may lead to persistently untreated infection. The persistently untreated HPI among children aged five to seven years is documented to be significantly associated with stunting than non-infected children in Germany, especially among male children [22].

Whether this has a relationship with the reported high prevalence of stunting among Rwandan children has not been investigated (37.0% among males and 29.2% among females) [23].

However, the lack of evidence-based guidelines in the workplace reported by 75% of pediatricians in this study would hinder good practice. To express the need for action, our results have also shed light on the pediatricians' strong determination to implement evidence-based practice, would the guidelines be available in their workplace.

While endoscopy is considered the recommended diagnostic test for HPI among children [24], it was utilized by only 31.3% of pediatricians in this study. It is important to note that, in Rwandan public health institutions, endoscopic evaluation is available at only four referral hospitals, of which three are in the country's capital city. In addition, the country's public health insurance does not allow non-emergency patients to go directly to referral hospitals [25] unless they are accepting to afford the totality of the medical bill, which would be expensive to the majority of Rwandans. The low use of endoscopic exams is further supported by the resulting availability of endoscopy for only 15% of pediatricians in this study. Therefore, it is not surprising that over 90% of pediatricians in this study are widely using other supportive non-invasive tests such as stool antigen and serology antigen tests to diagnose HPI in children [24,26].

However, this is contrary to the standard "guidelines for the management of HPI in children and adolescents" that do not recommend the use of either serology or non-invasive tests for the initial diagnosis of HPI except in special cases such as children with immune thrombocytopenic purpura or first-degree family history of gastric cancer [24,27]. This wide utilization of antigen detection as the primary diagnostic approach for HPI was similar to the results from Ethiopia, and Latvia [28,29].

Similarly, over 81% of primary care pediatricians in the USA, also reported using serology antigens as the primary HPI diagnostic test [17]. The availability of endoscopic exams at the workplace reported by only 15% but utilized by 31.3% indicates a well-functioning inter-facility collaboration where patients who are evaluated in settings that do not own an endoscopic technology are referred to undergo the exam to other settings where it is available.

Although there is no recommendation for systematic testing or screening for HPI among children, documented indications should alert pediatricians to rule out the possibility of HPI, including anemia, a common finding in one-third of Rwandan children aged under five [30].

The results from our study show that the pharmacological choices to treat HPI in children in Rwanda are by the "Joint ESPGHAN/NASPGHAN Guidelines for the Management of H.pylori in Children and Adolescents" updated in 2016, suggesting the use of a PPI with amoxicillin and clarithromycin or metronidazole [27].

However, while these joint guidelines recommend a treatment period of 14 days, only 56% of our respondents were practicing adherence to the recommended 14 days, with the remainder prescribing the antibiotics for either a shorter or longer duration. Due to the critical importance of prescribing the correct medications, for the correct frequency and duration of administration for the successful eradication of HPI [31].

This wide variability in the prescription duration of antibiotics against HPI can also be a result of the lack of guidelines at the workplace as reported by most pediatricians in this study and hence the practice lacks standardization.

CONCLUSIONS AND RECOMMENDATIONS

Rwandan pediatricians are aware of the current evidence on H. pylori and are willing to utilize evidence-based guidelines. The results express a need to institutionalize the existing evidence on HPI among the pediatric population and a need to promote continuous medical education for capacity building of the pediatricians. Where possible, hospitals should create and sustain the inter-facility agreement to utilize the existing minimum capacity, to serve the maximum number of patients, as stated by Sustainable Development Goal 17.

We recommend to the Ministry of Health approve and endorse newly developed guidelines for diagnosing and managing pediatric HPI in Rwanda. We recommend developing a pediatric gastroenterology training program and availing diagnostic modalities and organizing community-oriented health education on HPI to maximize the utilization of the available pediatric healthcare services in the country.

We recommend also the Rwanda Pediatric Association institutionalize the already existing evidence on HPI among the pediatric population and a need to promote continuous medical education for capacity building of the pediatricians. Continuous medical education should include education on evidence-based guidelines for the management of HPI. We recommend this training be delivered at all teaching and district hospitals for maximum uptake.

Pediatricians are encouraged to enhance health education for patients on preventive measures to decrease the rate of reinfection. Education should be delivered at the hospital and community levels [32].

In the future, we recommend the use of this tool in a separate population of pediatric providers to assess the validity of the questionnaire.

The prospective nature of this study allowed the recruitment of real-time information from the study participants. Other strengths rely on the recruitment of pediatricians in clinical practice and experience in the subject matter from all the country's rural and urban health districts. The self-administered questionnaire also allowed the participants to freely respond to the study questions, facilitating the analysis of their lived experiences.

However, the low number of pediatricians in the country was a limitation to generate a more powerful sample size that would have stimulated a logistic regression model for analysis. Responses may have social desirability bias as pediatricians were likely to want to be seen favorably.

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